Sustainability of Digital Formats: Planning for Library of Congress Collections

TIFF, Revision 6.0

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Format Description Properties ⓘ

- ID: fdd000022
- Short name: TIFF_6
- Content categories: still-image
- Format Category: file-format
- Other facets: container-wrapper, binary, unstructured, sampled
- Last significant FDD update: 2024-05-06
- Draft status: Full

Identification and description ⓘ

Full name	TIFF (Tagged Image File Format), Revision 6.0
Description	A tag-based file format for storing and interchanging raster images. TIFF serves as a wrapper for different bitstream encodings for bit-mapped (raster) images. The different encodings may represent different compression schemes and different schemes for color representation (photometric interpretation). See also Notes. The most recent version of TIFF is 6.0, published in 1992. Since TIFF images conforming to earlier versions are valid TIFF 6.0 files, the information in this description is also pertinent to earlier versions of the TIFF standard. Many TIFF files with uncompressed image data are still being created as TIFF 5.0 files. One limiting factor for TIFF is file size. As described in Use and Export BigTIFF Files, "in the standard TIFF format, [the] offset is specified by a 32-bit integer (4 bytes). The largest offset that can be specified is thus 232 bytes, or 4 GB." The post BigTIFF - Exceeding the 4 GB Limit from 2018 adds that "most desktop computers had about 2-4 MBytes of RAM at that time so a 4 GB limit seemed to have plenty of head room." But this 4 GB maximum file size limit is a hindrance when dealing with detailed, complex or large images. In 2004, BigTIFF was founded which changed the offset value as a 64-bit integer (8 bytes) which extends the theoretical maximum file size to 18,000 PB (petabytes).
Production phase	Most often an initial-state or middle-state format; may serve as final-state format.
Relationship to other formats	
Has earlier version	TIFF, Revision 5.0, not separately described
Has subtype	TIFF_UNC, TIFF, Uncompressed Bitmap
Has subtype	TIFF_G4, TIFF Bitmap with Group 4 Compression
Has subtype	TIFF_LZW, TIFF Bitmap with LZW Compression
Has subtype	TIFF_PYR, TIFF, Pyramid
Has subtype	TIFF/IT, TIFF/IT, for Image Technology
Has subtype	TIFF/EP, TIFF/EP, for Digital Photography
Has subtype	DNG_1_1, Adobe Digital Negative (DNG), Version 1.1
Has subtype	GeoTIFF_1_0, GeoTIFF, Revision 1.0
Has subtype	DNG_1_6, Adobe Digital Negative (DNG), Version 1.6. Adobe Digital Negative (DNG), Version 1.6.0.0 (2020), not described at this Web site at this time
Has extension	BigTIFF, BigTIFF
May contain	Bitstream encodings for other compression schemes, not documented at this time.

Local use ⓘ

| LC experience or existing holdings | The Library has many TIFF files in its digital collections - over 3.5PB in early 2022 - across numerous collections. The Library leads the Federal Agencies Digital Guidelines Initiative (FADGI) Still Image Working Group and follows its recommendations for Technical Guidelines for Digitizing Cultural |

	Heritage Materials which include the use of TIFF as a format for primary or master files files in many content categories for the Library's digitization workflows.
LC preference	The Library of Congress Recommended Formats Statement (RFS) includes TIFF as an preferred format for photographs in digital form, other graphic images in digital form, 2D and 3D Computer Aided Design raster images and accompanying image/text files for audio. TIFF, along with accompanying TIFF World File files, is an acceptable format for GIS Raster and Georeferenced Images. The RFS does not specify a version of TIFF.

Sustainability factors ⓘ

Disclosure	Fully documented. TIFF was developed by the Aldus and Microsoft Corporations, and the specification is owned by Aldus (now absorbed into the Adobe Corporation). The TIFF tag set is extensible through a registry maintained by Adobe; the list of registered extensions is not available from Adobe; see Tags for TIFF and Related Specifications.
Documentation	TIFF, Revision 6.0, Final -- June 3, 1992. Link via Internet Archive. TIFF 5.0 Aldus/Microsoft Technical Memorandum: 8/8/88 (at https://cool.culturalheritage.org/bytopic/imaging/std/tiff5.html)
Adoption	Particular subtypes are very widely deployed as master formats for scanned images. Not supported by all browsers in native format but, as of early 2004, new PC configurations tend to include a viewer. The format is widely supported by image-manipulation applications (Adobe Photoshop and many others), by desktop publishing and page layout applications (QuarkXPress, Adobe InDesign, and others), and by scanning, faxing, word processing, optical character recognition, and other applications. Particular TIFF subtypes are data formats given High confidence status for preservation in the FLVC table of formats for its digital archive. Library and Archives Canada has adopted TIFF as a recommended format for still images. EXIF metadata (see TIFF_UNC_EXIF and TIFF/EP), a desirable form of self-documentation, is very often provided by digital cameras.
Licensing and patents	Not exploited for the TIFF wrapper format. The only widely used compression scheme for the embedded image data that has been subject to patent claims in recent years is LZW (Lempel-Ziv-Welch) compression, i.e., in TIFF_LZW. The LZW patent is generally reported as having expired in 2003 (U.S.) and 2004 (Europe and Japan).
Transparency	Depends on bitstream encoding.
Self-documentation	The TIFF specification defines a framework for an Image File Header (IFH), Image File Directories (IFDs), and associated bitmaps. Each IFD and its associated bitmap are sometimes called a *TIFF subfile*. There is no limit to the number of subfiles a TIFF image file may contain. Each IFD contains one or more data structures called *tags*, each one of which is a 12-byte record that contains a specific piece of information about the bitmapped data. The TIFF specification defines a number of tags and a set of rules for extensibility; see Tags for TIFF and Related Specifications. Tags are always found in contiguous groups within each IFD. **Accessibility Features** Accessibility for still image content is often supported by the use of alt text when displayed on the web. The carriage of this data is typically not embedded in the file itself but rather in the HTML code. TIFF files have moderate support for accessibility features through the use of embedded metadata in TIFF tags. For example, ImageDescription tag (code 270) describes the content of the image but this may not be accessible to screen readers.
External dependencies	None
Technical protection considerations	None

Quality and functionality factors ⓘ

Still Image	
Normal rendering	Good support. Except for file size limit of 4 GB which may be restrictive for complex uses. See BigTIFF.
Clarity (high image resolution)	Excellent support for images with very high spatial resolution. The standard is flexible as to color space and bit depth. In practice, 8-bit grayscale and 24-bit RGB color are common; some activities create files with greater than 8 bits per channel (color or grayscale).
Color maintenance	The TIFF tag for the ICC profile (tag 34675, *InterColourProfile*) for a capture device has been added as a "private" extension in the TIFF/IT and TIFF/EP standards.[1] Extended tags of this kind may be used in any TIFF_6 file, although they may not be recognized by all readers. ICC Profile version 4.2.0.0 (Specification ICC.1:2004-10, page 69) provides guidance for embedding ICC profiles in TIFF files: "as a single TIFF field or Image File Directory (IFD)." Meanwhile, Adobe Photoshop software appears to provide an alternate means to embed an ICC profile in a TIFF file; the compilers of this Web site seek explanatory comments from readers: how proprietary or interoperable is PhotoShop embedding of ICC profiles? Color space is indicated in *Photometric Interpretation* (tag 262); in TIFF_6, this tag does not include sRGB as a value, although sRGB images may be delivered tagged as RGB.[2]
Support for vector graphics, including graphic effects and typography	No support for vector graphics.
Functionality beyond normal rendering	Multi-page files supported for a sequence of images.

File type signifiers and format identifiers ⓘ

Tag	Value	Note
Filename extension	tif tiff	The TIFF 6.0 standard recommends the use of tif (or TIF) as extension. Macintosh Filetype is TIFF and tiff is sometimes found as a filename extension.
Internet Media Type	image/tiff	From the IETF (RFC2302).
Internet Media Type	image/tif image/x-tif image/x-tiff application/tif application/x-tif application/tiff application/x-tiff	Selected from The File Extension Source
Magic numbers	Hex: 49 49 2A 00	For little endian byte order; from the PRONOM PUID fmt/353 for TIFF.
Magic numbers	Hex: 49 49 ASCII: II	For little endian byte order; from Gary Kessler's File Signatures.
Magic numbers	Hex: 49 49 42 00 ASCII: II	For little endian byte order; from the IETF (RFC2302).
Magic numbers	Hex: 4D 4D 00 2A ASCII: MM	For big endian byte order; from the IETF (RFC2302).
Microsoft FOURCC	TIFF	From the IETF (RFC2302).
Pronom PUID	fmt/353	See https://www.nationalarchives.gov.uk/PRONOM/fmt/353. Pronom does not differentiate versions of TIFF.
Wikidata Title ID	Q27231633	See https://www.wikidata.org/wiki/Q27231633.

Notes ⓘ

General	The acronym TIFF is variously glossed as *Tagged* Image File Format and *Tag* Image File Format; the title page of the 1992 specification does not spell out the abbreviation. According to the Wikipedia article Tagged Image File Format (consulted on August 30, 2006), earlier versions of the specification used *Tag Image File Format*. FileFormatInfo offers an overview of the format: files are organized into three sections: the Image File Header (IFH), the Image File Directory (IFD), and the bitmap data. Of these three sections, only the IFH and IFD are required. It is possible to have a TIFF file with no bitmapped data, although such a file would be highly unusual. A TIFF file that contains multiple images has one IFD and one bitmap per image stored.
History	The Wikipedia article Tagged Image File Format (consulted on August 30, 2006) reports that the format was originally created by the company Aldus, jointly with Microsoft, for use with PostScript printing. FileFormatInfo reports that Aldus first published a TIFF specification in 1986 and many consider this to be "version 3". Another motive to create the specification was to encourage desktop scanner vendors of the mid-1980s to agree on a common scanned image file format, rather than have each company promulgate its own proprietary format. In the beginning, TIFF was only a bilevel image format, since that was all that desktop scanners could handle. As scanners became more powerful, and as desktop computer disk space became more plentiful, TIFF grew to accommodate grayscale images, then color images. Today, TIFF is a popular format for high-color-depth images, along with JPEG and PNG. Adobe Systems, which acquired the PageMaker publishing program from Aldus, now controls the TIFF specification.

Format specifications ⓘ

- Copies of the TIFF specification and related Technical Notes were formerly available at http:/partners.adobe.com/public/developer/tiff/index.html. In mid-2017 this page no longer exists. Immediately below are links to specifications via the Internet Archive. Further below are copies found at other locations.
    - Adobe Developer Resources related to TIFF. Link via Internet Archive (https://web.archive.org/web/20210108073850/https://www.adobe.io/open/standards/TIFF.html). Provides links to main specification for TIFF_6 and supplements.
    - TIFF Revision 6.0, Final, June 3, 1992. Link via Internet Archive. (https://web.archive.org/web/20180810205359/https://www.adobe.io/content/udp/en/open/standards/TIFF/_jcr_content/contentbody/download/file.res/TIF
    - Adobe PageMaker 6.0: TIFF Technical Notes, September 14, 1995 (https://web.archive.org/web/20180810205521/https://www.adobe.io/content/udp/en/open/standards/TIFF/_jcr_content/contentbody/download_1704706500 known as TIFF Specification Supplement 1. Adobe technical notes relating to TIFF files created by PageMaker. Link via Internet Archive.
    - Adobe Photoshop TIFF Technical Notes, March 22, 2002. (https://web.archive.org/web/20180810205806/https://www.adobe.io/content/udp/en/open/standards/TIFF/_jcr_content/contentbody/download_1370394221 known as TIFF Specification Supplement 2. This document describes use of JPEG compression within a TIFF image, correcting an earlier, flawed specification. Link via Internet Archive.
- TIFF Revision 5.0 (from Aldus) (https://cool.culturalheritage.org/bytopic/imaging/std/tiff5.html). From Conservation OnLine (CoOL).
- Specification of TIFF, version 6 from ITU. (https://www.itu.int/itudoc/itu-t/com16/tiff-fx/docs/tiff6.pdf). TIFF, version 6 is the basis for TIFF-FX (Tag Image File Format Fax eXtended).
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- Specification of TIFF, version 6 from AlternaTIFF. (https://www.alternatiff.com/resources/TIFF6.pdf).
- Adobe PageMaker 6.0: TIFF Technical Notes, September 14, 1995 (https://www.alternatiff.com/resources/TIFFPM6.pdf). From AlternaTIFF.
- Adobe Photoshop TIFF Technical Notes, March 22, 2002. (https://www.alternatiff.com/resources/TIFFphotoshop.pdf). From AlternaTIFF.

Useful references

URLs

- [JHOVE TIFF-hul module](http://jhove.sourceforge.net/tiff-hul.html) (http://jhove.sourceforge.net/tiff-hul.html).
- [TIFF at FileFormat.Info](https://www.fileformat.info/format/tiff/index.dir) (https://www.fileformat.info/format/tiff/index.dir).
- The Encyclopedia of Graphic File Formats, 2nd Edition, 1996 (EGFF) has information on this format. See print citation below. Online access is available at:
  - [EGFF: TIFF File Format Summary](https://www.fileformat.info/format/tiff/egff.htm) (https://www.fileformat.info/format/tiff/egff.htm). From FileFormat.Info. This presentation states that the work has been released under a Creative Commons Attribution license.
  - [EGFF: TIFF](http://netghost.narod.ru/gff/graphics/summary/tiff.htm) (http://netghost.narod.ru/gff/graphics/summary/tiff.htm). Copy made available from a site in Russia.
- [BigTIFF - Exceeding the 4GB Limit, November 2018](https://www.artwork.com/raster/bigtiff.htm) (https://www.artwork.com/raster/bigtiff.htm). From Artwork Conversion Software, Inc.
- [Use and Export BigTIFF Files](https://www.microimages.com/documentation/TechGuides/74bigTIFF.pdf) (https://www.microimages.com/documentation/TechGuides/74bigTIFF.pdf).
- [Niles Ritter's Unofficial TIFF Home Page](https://www.nilesritter.com/webdocs/tiff/) (https://www.nilesritter.com/webdocs/tiff/).
- [Guidance for Digitizing Images](https://web.archive.org/web/20130718234028/http://preserve.harvard.edu/guidelines/imagedig.html) (https://web.archive.org/web/20130718234028/http://preserve.harvard.edu/guidelines/imagedig.html). From Harvard University Library. Link via Internet Archive.
- [AWare Systems TIFF FAQ](https://www.awaresystems.be/imaging/tiff/faq.html) (https://www.awaresystems.be/imaging/tiff/faq.html).
- [AWare Systems info about TIFF tags](https://www.awaresystems.be/imaging/tiff/tifftags.html) (https://www.awaresystems.be/imaging/tiff/tifftags.html).
- [Tags for TIFF and Related Specifications](https://www.loc.gov/preservation/digital/formats/content/tiff_tags.shtml) (https://www.loc.gov/preservation/digital/formats/content/tiff_tags.shtml). From Library of Congress resource: Sustainability of Digital Formats.
- [Guidelines: TIFF Image Metadata](https://www.digitizationguidelines.gov/guidelines/digitize-tiff.html) (https://www.digitizationguidelines.gov/guidelines/digitize-tiff.html). From the Federal Agencies Still Image Digitization Working Group.
- [ICC Profile version 4.2.0.0](https://www.color.org/icc1V42.pdf) (https://www.color.org/icc1V42.pdf).
- [Ross Finlayson's TIFF Web page (from Internet Archive)](https://web.archive.org/web/20070627164620/http://www.tiki-lounge.com/~raf/tiff/fields.html) (https://web.archive.org/web/20070627164620/http://www.tiki-lounge.com/~raf/tiff/fields.html).
- [Paul Bourke's TIFF Image Creation instructions](http://paulbourke.net/dataformats/tiff/) (http://paulbourke.net/dataformats/tiff/).
- [Practical Analysis of TIFF File Size Reductions Achievable Through Compression. By Peter May and Kevin Davies. 2016](https://ead.nb.admin.ch/web/ipres2016/frontend/organizers/media/iPRES2016/_PDF/IPR16.Proceedings_4_Web_Broschuere_Link.pdf#page=65) (https://ead.nb.admin.ch/web/ipres2016/frontend/organizers/media/iPRES2016/_PDF/IPR16.Proceedings_4_Web_Broschuere_Link.pdf#page=65). From the British Library.
- The Florida Digital Archive, a service of the State University Library Services (Florida Virtual Campus) has developed a table of preservation levels and action plans for various digital formats. Formats with High as preservation confidence level are recommended. As of mid-2017, the relevant area of the FLVC website is being re-organized and the useful table is no longer online. The links below are to archived web pages.
  - [FCLA Table of Formats and Action Plans from fclaweb.fcla.edu. Archived at Internet Archive in September 2016.](https://web.archive.org/web/20160914160338/http://fclaweb.fcla.edu/node/795) (https://web.archive.org/web/20160914160338/http://fclaweb.fcla.edu/node/795).
  - [FCLA Table of Formats and Action Plans from fclaweb.fcla.edu. Archived at archive.is](https://archive.is/4GjFC) (https://archive.is/4GjFC). This URL is for the table, but most links to supporting documents do not work in this archived page.
- [Library and Archives Canada Guidelines on File Formats for Transferring Information Resources of Enduring Value, as of October 2014.](https://www.bac-lac.gc.ca/eng/services/government-information-resources/guidelines/Documents/file-formats-irev.pdf) (https://www.bac-lac.gc.ca/eng/services/government-information-resources/guidelines/Documents/file-formats-irev.pdf).
- [PRONOM entry for fmt/353](https://www.nationalarchives.gov.uk/pronom/fmt/353) (https://www.nationalarchives.gov.uk/pronom/fmt/353). Information in PRONOM from UK National Archives about Tagged Image File Format, although it does not differentiate between versions of TIFF. PUID: fmt/353.
- [Wikidata entry for Q27231633](https://www.wikidata.org/wiki/Q27231633) (https://www.wikidata.org/wiki/Q27231633). Information in Wikidata about TIFF Revision 6.0. Wikidata Title ID: Q27231633.

Books, articles, etc.

- Murray, James D. and William vanRyper. Encyclopedia of Graphics File Formats, 2nd Edition. Sebastopol, CA. : O'Reilly & Associates, 1996. Includes CD-ROM with complete text of book, and copies of several file format specifications.

[1]The most effective color maintenance systems rely on the existence of an ICC (International Color Consortium) profile of the capture device, which can then be compared to profiles for output devices, permitting appropriate adjustments of image color.

[2]The color space sRGB, standardized as IEC 61966-2-1, establishes an image viewing environment with a known color temperature (6500 degrees Kelvin) and gamma (2.2), thus increasing the user's ability to maintain color.